WHAT IS CLAIMED IS:

1. A digital linearizer comprising:

a main amplifying unit configured to amplify a digital input signal on a first path;

a distortion component detecting unit coupled to receive the digital input signal on a second path and an output signal of the main amplifying unit and detect distortion components from the output signal of the main amplifying unit; and

a correlating unit coupled to receive the digital input signal on a third path and the detected distortion components and configured to correlate the detected distortion components with the digital input signal to adaptively control the distortion component detecting unit.

2. The digital linearizer of claim 1, wherein the distortion component detecting unit outputs a compensation signal that is applied to the amplified digital input signal to remove a distortion component.

3. The digital linearizer of claim 1, wherein the correlating unit is configured to adaptively control a gain of the digital input signal on the second path according to a level of the distortion components.

[redacted]

4. The digital linearizer of claim 1, further comprising:

an error amplifying unit configured to amplify the detected distortion components received from the distortion component detection unit; and

a directional coupler configured to couple the output signal of the main amplifying unit with an output signal of the error amplifying unit to remove the distortion components from the output signal of the main amplifying unit.

5. The digital linearizer of claim 1, wherein the distortion component detection unit comprises a gain controller configured to control a gain of the digital input signal on the second path according to a gain control signal output from the correlating unit.

6. The device of claim 5, wherein the gain controller is coupled to receive first and second gain control signals to individually control first and second components of the digital input signal.

7. The device of claim 6, wherein the first component of the digital input signal is an In-phase component I and wherein the second component of the digital input signal is a quadrature phase component Q.

8. The digital linearizer of claim 5, wherein the distortion component-detecting unit further comprises:

a first delay configured to delay the second digital input signal on the second path and to provide a delayed digital input signal to the gain controller;

a second delay configured to delay an output signal of the gain controller;

a mixer configured to convert the output signal of the main amplifying unit into an intermediate frequency (IF) signal;

an analog-to-digital converter (ADC) configured to convert the IF signal to an intermediate digital signal; and

a subtracter configured to subtract the intermediate digital signal from the gain controlled digital input signal to detect the distortion components.

9. The digital linearizer of claim 8, wherein the gain controller comprises:

a digital analog converter (DAC) configured to convert the delayed digital input signal into a delayed analog input signal;

a hybrid divider configured to divide the delayed analog input signal into an in-phase signal I and a quadrature phase signal Q;

first and second multipliers configured to multiply the in-phase signal I by an in-phase component of the gain control signal and multiply the quadrature phase signal Q by a quadrature phase component of the gain control signal, respectively;

[redacted]

a coupler configured to couple an output of the first multiplier with an output of the second multiplier; and

an analog-to-digital converter (ADC) configured to convert an analog output of the coupler to the gain-controlled digital signal.

10. The digital linearizer of claim 1, wherein the correlating unit comprises:

a first delay configured to delay the digital input signal on the third path;

a second delay configured to delay the detected distortion components; and

a correlator configured to correlate an output of the first delay with an output of the second delay to generate a gain control signal.

11. The digital linearizer of claim 7, wherein the gain control signal comprises an in-phase gain control signal and a quadrature phase gain control signal.

12. The digital linearizer of claim 11, wherein the in-phase gain control signal and quadrature gain control signal are provided to a gain controller of the distortion component detecting unit to control a gain of the digital input signal on the second path.

13. The digital linearizer of claim 10, wherein the correlator comprises:

a first digital-to-analog converter (DAC) configured to convert the output of the first delay into a first analog delay signal;

a hybrid divider configured to divide the first analog delay signal into an in-phase signal I and a quadrature phase signal Q;

a second DAC configured to convert the output of the second delay into a second analog delay signal;

first and second multipliers configured to multiply the in-phase signal I by the second analog delay signal and multiply the quadrature phase signal Q by the second analog delay signal, respectively; and

first and second magnitude calculators configured to calculate a magnitude of output signals of each of the first and second multipliers, to generate first and second gain control signals.

14. The digital linearizer of claim 11, wherein the first gain control signal is an in-phase gain control signal, and wherein the second gain control signal is a quadrature phase gain control signal.

15. A digital linearizer, comprising:

a main amplifying unit configured to amplify a digital input signal on a first path;

a distortion component detecting unit configured to process the digital input signal on a second path with an output signal of the main amplifying unit, and to detect distortion components from the output signal of the main amplifying unit;

a correlating unit configured to correlate the detected distortion components with the digital input signal on a third path, to adaptively control the distortion component detecting unit;

an error amplifying unit configured to amplify the detected distortion components; and

a directional coupler configured to couple the output of the main amplifying unit with an output of the error amplifying unit to remove the distortion components included in the output signal of the main amplifying unit.

16. The digital linearizer of claim 15, wherein the distortion component-detecting unit comprises:

a first delay configured to delay the digital input signal on the second path;

a gain controller configured to control the gain of the digital input signal on the second path according to a gain control signal output from the correlating unit;

a second delay configured to delay an output signal of the gain controller;

a mixer configured to convert an output signal of the main amplifying unit into an IF signal;

an analog to digital converter (ADC) configured to convert the IF signal to an intermediate digital signal; and

a subtracter configured to subtract the intermediate digital signal from the gain controlled digital input signal to detect the distortion components.

17. The digital linearizer of claim 15, wherein the correlating unit comprises:

a first delay configured to delay the digital input signal on the third path;

a second delay configured to delay the detected distortion components; and

a correlator configured to correlate the output of the first delay with the output of the second delay, to generate a gain control signal.

18. The digital linearizer of claim 17, wherein the correlator comprises:

a first digital-to-analog converter (DAC) configured to convert the output of the first delay into a first analog delay signal;

a hybrid divider configured to divide the first analog delay signal into an in-phase signal I and a quadrature phase signal Q;

a second DAC configured to convert the output of the second delay into a second analog delay signal;

[redacted]

first and second multipliers configured to multiply the in-phase signal I by the second analog delay signal and multiply the quadrature phase signal Q by the second analog delay signal, respectively; and

first and second magnitude calculators configured to calculate a magnitude of the output signals of each of the first and second multipliers, to generate first and second gain control signals.

19. The digital linearizer of claim 16, wherein the gain controller comprises:

a digital-to-analog converter (DAC) configured to convert the delayed digital input signal into a delayed analog input signal;

a hybrid divider configured to divide the delayed analog input signal into an in-phase signal I and a quadrature signal Q;

first and second multipliers configured to multiply the in-phase signal I by an in-phase component of the gain control signal and multiply the signal Q by a quadrature phase component of the gain control signal, respectively;

a coupler configured to couple an output of the first multiplier with an output of the second multiplier; and

an analog-to-digital converter (ADC) configured to convert an analog output of the coupler to the gain controlled digital signal.

20. A digital linearizing method, comprising:

amplifying a digital input signal on a first path;

processing the amplified digital input signal of the first path with the digital input signal on a second path to detect a distortion component of the amplified digital input signal; and

correlating the detected distortion components with the digital input signal on a third path to adaptively control a gain of the digital input signal on the second path.

21. The method of claim 20, further comprising:

amplifying the detected distortion components; and

coupling the amplified digital input signal of the first path with the amplified distortion components to remove the distortion components included in the amplified digital input signal of the first path.

22. The method of claim 20, wherein processing comprises:

controlling a gain of the digital input signal on the second path according to a gain control signal;

converting the amplified digital input signal of the first path into an IF signal and converting the IF signal into an intermediate digital signal; and

subtracting the intermediate digital signal from the gain controlled digital input signal of the second path, to detect the distortion components.

23. The method of claim 20, wherein correlating comprises:

converting the digital input signal on the third path into a first analog signal;

dividing the first analog signal into an in-phase signal I and a quadrature phase signal Q;

converting the detected distortion components into a second analog signals;

multiplying the in-phase signal I and the quadrature phase signal Q by the second analog signals; and

calculating a magnitude of each of the multiplications, to generate in-phase and quadrature phase components of the gain of the digital input signal on the second path.

24. A digital linearizing method comprising:

amplifying a digital input signal on a first path to generate an amplified digital input signal;

processing the amplified digital input signal with the digital input signal on a second path to detect distortion components of the amplified digital input signal;

correlating the detected distortion components with the digital input signal on a third path, to adaptively control a gain of the digital input signal on the second path;

amplifying the detected distortion components; and

coupling the amplified digital input signal with the amplified distortion components to remove the distortion components included in the amplified digital input signal.

25. The method of claim 24, wherein processing comprises:

controlling a gain of the digital input signal according to a gain control signal;

converting the amplified digital input signal into an IF signal;

converting the IF signal into an intermediate digital signal; and

subtracting the intermediate digital signal from the gain controlled digital input signal on the second path, to detect the distortion components.

26. The method of claim 24, wherein correlating comprises:

converting the digital input signal on the second path into a first analog signal;

dividing the first analog signal into an in-phase signal I and a quadrature phase signal Q;

converting the detected distortion components into a second analog signal and dividing the second analog signal;

multiplying the in-phase signal I and the quadrature phase signal Q by the second analog signal; and

calculating a magnitude of each of the multiplications, to generate the in-phase and quadrature phase components of the gain control signal for the digital input signal on the second path.

27. A signal processing device, comprising:

a first digital-to-analog converter (DAC) configured to receive a digital input signal and convert the digital input signal into an analog input signal;

a first hybrid divider coupled to receive the analog input signal and configured to divide the analog input signal into a first in-phase signal I and a first quadrature phase signal Q;

first and second multipliers configured to multiply the first in-phase signal I and the first quadrature phase signal Q by first and second components of a gain signal, respectively;

a coupler coupled to the first and second multipliers and configured to combine the outputs of the first and second multipliers into a gain controlled analog input signal;

a first analog-to-digital converter (ADC) configured to convert the gain controlled analog input signal into a gain controlled digital input signal.

28. The device of claim 27, further comprising:

a first delay configured to delay the digital input signal;

a second delay configured to delay the gain controlled digital input signal;

a first mixer configured to receive an amplified digital input signal and mix the amplified digital input signal with a local oscillator (LO) signal to generate an intermediate frequency (IF) signal;

a second ADC configured to convert the IF signal to an intermediate digital signal; and

a subtracter configured to subtract the intermediate digital signal from the delayed gain controlled digital input signal to generate detected distortion components.

29. The device of claim 28, further comprising:

a main amplifying unit configured to receive the digital input signal and output the amplified digital input signal;

a correlating unit configured to receive the digital input signal and the detected distortion components and output the first and second components of the gain signal;

an error amplifying unit configured to amplify the detected distortion components;

a third delay configured to delay the amplified digital input signal; and

a directional coupler configured to couple the delayed and amplified digital input signal with the amplified detected distortion components to remove the amplified detected distortion components from the delayed and amplified digital input signal.

30. The device of claim 29, wherein the correlating unit comprises:

a fourth delay configured to receive and delay the digital input signal;

a fifth delay configured to receive and delay the detected distortion components; and

a correlator coupled to the fourth and fifth delays and configured to generate the gain signal.

31. The device of claim 30, wherein the correlator comprises:

a second DAC configured to receive the delayed digital input signal and output a first analog delay signal;

a second hybrid divider configured to divide the first analog delay signal into a second in-phase signal I and a second quadrature phase signal Q;

a third DAC configured to receive the delayed detected distortion components and output a second analog delay signal;

third and fourth multipliers configured to multiply each of the second in-phase signal I and the second quadrature phase signal Q by the second analog delay signal; and

first and second magnitude calculators coupled to third and fourth multipliers, respectively, and configured to generate first and second components of the gain signal.

32. A signal processing device, comprising:

a first digital-to-analog converter (DAC) configured to receive a delayed digital input signal and output a first analog delay signal;

a first hybrid divider configured to divide the first analog delay signal into a first in-phase signal I and a first quadrature phase signal Q;

a second DAC configured to receive the delayed detected distortion components and output a second analog delay signal;

first and second multipliers configured to multiply each of the first in-phase signal I and the first quadrature phase signal Q by the second analog delay signal; and

first and second magnitude calculators coupled to third and fourth multipliers, respectively, and configured to generate first and second components of a gain signal.